[0025] As illustrated in FIG. 1, the printer 1 includes a moving mechanism 6 that moves (reciprocates) a carriage 20 in the main scan direction (X-direction).

[0026] The moving mechanism 6 includes a carriage motor 61 that moves the carriage 20, a carriage guide shaft 62 that is secured on each end, and a timing belt 63 that extends almost parallel to the carriage guide shaft 62, and is driven by the carriage motor 61.

[0027] The carriage 20 is reciprocally supported by the carriage guide shaft 62, and is secured on part of the timing belt 63. Therefore, when the timing belt 63 is moved forward and backward by the carriage motor 61, the carriage 20 reciprocates while being guided by the carriage guide shaft 62.

[0028] A print head 22 is provided to the carriage 20. The print head 22 includes a plurality of nozzles that are provided in an area opposite to the medium P, and independently eject the ink in the Z-direction. The print head 22 is schematically divided into four blocks in order to implement color printing. Each block ejects a black (Bk) ink, a cyan (C) ink, a magenta (M) ink, or a yellow (Y) ink.

[0029] Various signals and the like including a drive signal are supplied to the carriage 20 from a main board (not illustrated in FIG. 1) through a flexible cable 190.

[0030] The printer 1 includes a feed mechanism 8 that feeds the medium P on a platen 80. The feed mechanism 8 includes a feed motor 81 (i.e., drive source), and a feed roller 82 that is rotated by the feed motor 81, and feeds the medium P in the sub-scan direction (Y-direction).

[0031] An image is formed on the surface of the medium P by repeating an operation that ejects the ink from the nozzle of the print head 22, and feeds the medium P by using the feed mechanism 8 in synchronization with the main scan operation of the carriage 20.

[0032] In the first embodiment, the main scan operation is implemented by moving the carriage 20, and the sub-scan operation is implemented by feeding the medium P. Note that the print head 22 may be fixed, and the medium P may be moved in the X-Y-directions. Alternatively, both the carriage 20 and the medium P may be moved. It suffices that the medium P and the carriage 20 (print head 22) move relative to each other.

[0033] FIG. 2 illustrates the ink ejection plane of the print head 22 when viewed from the medium P.

[0034] As illustrated in FIG. 2, the print head 22 includes four head units 3. The four head units 3 are arranged in the X-direction (i.e., main scan direction), and respectively correspond to black (Bk), cyan (C), magenta (M), and yellow (Y). Each head unit 3 includes a plurality of nozzles N that are arranged in two rows along the Y-direction. The head unit 3 has a structure in which a piezoelectric element (i.e., actuator) provided to an actuator substrate is sealed with a driver IC (as described in detail later).

selection control section 510, and applies the selected drive signal COM-A or COM-B to one end of the corresponding piezoelectric element Pzt as a voltage Vout drive signal.

[0057] Since the selection control section 510 merely instructs the selection section 520 to select the drive signal COM-A or COM-B, the elements (transistors) that form the selection control section 510 can be designed according to a low-voltage specification.

[0058] Since the maximum voltage of the drive signal COM-A is about 40 V, the elements (transistors) (including a level shifter that converts the output from the selection control section 510 into a high-amplitude signal) that form the selection section 520 are designed according to a high-voltage specification so as to withstand such a high voltage.

[0059] The piezoelectric elements Pzt (actuators) are provided to the actuator substrate 40 so as to have a one-to-one relationship with the nozzles N. The other end of each of the piezoelectric elements Pzt is electrically connected in common, and the voltage V_{BS} generated by the voltage generation circuit 130 is applied to the other end of each of the piezoelectric elements Pzt.

[0060] The voltage Vout applied to one end of each of the piezoelectric elements Pzt changes corresponding to the size of the dot to be formed, and the voltage VBS is applied in common to the other end of each of the piezoelectric elements Pzt. Therefore, a relatively large amount of current flows through the voltage V_{BS} path.

[0061] FIG. 4 illustrates the arrangement of the drive electrodes of the piezoelectric elements Pzt and the nozzles N provided to the actuator substrate 40. Note that FIG. 4 illustrates a state viewed from the driver IC 50 situated opposite to the medium P in the ink ejection direction. FIG. 4 illustrates a state before the driver IC 50 of the head unit 3 is provided.

[0062] The actuator substrate 40 (head unit 3) has a configuration in which a plurality of nozzles N are arranged in two rows (see above). These nozzle rows are referred to as a nozzle row Na (first array) and a nozzle row Nb (second array) for convenience of explanation.

[0063] Each of the nozzle rows Na and Nb includes a plurality of nozzles N that are arranged along the Y-direction at a pitch P1. The nozzle rows Na and Nb are spaced in the X-direction by a pitch P2. The nozzles N that belong to the nozzle row Na and the nozzles N that belong to the nozzle row Nb are shifted in the Y-direction by half the pitch P1. It is possible to substantially double the resolution in the Y-direction as compared with the case where the nozzles N are arranged in one row by arranging the nozzles N in the two nozzle rows Na and Nb so that the nozzles N that belong to the nozzle row Na and the nozzles N that belong to the nozzle row Nb are shifted in the Y-direction by half the pitch P1.

442 communicates with the nozzle N through the communication flow channel 426 formed in the flow channel substrate 42.

[0071] The piezoelectric element Pzt is formed on the surface of the diaphragm 46 that is situated opposite to the pressure chamber substrate 44, the piezoelectric element Pzt being provided corresponding to each nozzle N (cavity 442).

[0072] The piezoelectric element Pzt includes a drive electrode 72a that is formed on the surface of the diaphragm 46 and provided common to a plurality of piezoelectric elements Pzt that correspond to the nozzle row Na, a piezoelectric material 74 that is formed on the surface of the drive electrode 72a, and a drive electrode 76a that is formed on the surface of the piezoelectric material 74 and provided corresponding to each piezoelectric element Pzt. An area in which the piezoelectric material 74 is sandwiched between the drive electrodes 72a and 76a functions as the piezoelectric element Pzt.

[0073] Note that the piezoelectric element Pzt that corresponds to the nozzle row Nb includes a drive electrode 72b, the piezoelectric material 74, and a drive electrode 76b. Note that the drive electrodes of the piezoelectric element Pzt that corresponds to the nozzle row Na are referred to as the drive electrodes 72a and 76a, and the drive electrodes of the piezoelectric element Pzt that corresponds to the nozzle row Nb are referred to as the drive electrodes 72b and 76b in order to electrically discriminate the piezoelectric element Pzt that corresponds to the nozzle row Na and the piezoelectric element Pzt that corresponds to the nozzle row Nb. The drive electrodes 72a and 72b are separated physically, but are connected electrically since the voltage V_{BS} is applied in common to the drive electrodes 72a and 72b.

[0074] The piezoelectric material 74 is formed by a process that includes a heat treatment (calcining), for example. Specifically, the piezoelectric material 74 is formed by applying a piezoelectric substance to the surface of the diaphragm 46 on which the drive electrodes 72a and 72b are formed, calcining the piezoelectric substance by performing a heat treatment inside a calcination furnace, and forming (e.g., plasma milling) the calcined piezoelectric substance corresponding to each piezoelectric element Pzt.

[0075] Although an example in which the drive electrode 72a (72b) is provided under the piezoelectric material 74 and the drive electrode 76a (76b) (independent drive electrode) is provided on the piezoelectric material 74 has been described above, the drive electrode 72a (72b) may be provided on the piezoelectric material 74, and the drive electrode 76a (76b) may be provided under the piezoelectric material 74.

[0076] As described above, the voltage Vout of the drive signal that corresponds to the amount of ink that should be ejected is independently applied to the drive electrode 76a (76b) (i.e., one end) of the piezoelectric element Pzt, and the voltage V_{BS} hold signal

600.

[0124] The printer 1 according to the third embodiment is a line printer in which the print head 600 is not moved, and does not include the moving mechanism 6. The print head 600 extends in the X-direction that is orthogonal to the feed direction (Y-direction).

[0125] FIG. 13 is a plan view illustrating the print head 22 viewed from the medium P.

[0126] As illustrated in FIG. 13, the print head 22 has a configuration in which a plurality of basic modules U are arranged along the X-direction. The module U includes a plurality of (e.g., six) head units 3 that are arranged along the X-direction. The head unit 3 is configured in the same manner as described above in connection with the first embodiment. A plurality of nozzles N are arranged along a W1-direction that is tilted by an angle θ with respect to the Y-direction (i.e., the feed direction in which the medium P is fed).

[0127] The printer 1 forms an image on the surface of the medium P by causing each head unit 3 to eject the ink toward the medium P in synchronization with the feed of the medium P in the Y-direction.

[0128] FIG. 14 illustrates the arrangement of the area H (in which a high-voltage transistor and the like are formed) and the area L (in which a low-voltage transistor and the like are formed) included in the head unit 3.

[0129] As illustrated in FIG. 14, since the areas L of the contiguous head units 3 of the diagonal head are situated close to each other, and the areas H are situated away from each other, it is possible to reduce or suppress interference between the contiguous head units 3.

[0130] Although an example in which the voltage V_{BS} hold signal from the main board 100 is applied to the actuator substrate 40 through the driver IC 50 has been described above, the voltage V_{BS} hold signal from the main board 100 may be supplied directly to the actuator substrate 40. In either case, the resistance of the voltage V_{BS} path decreases since the drive electrode 72a (72b) and the wiring pattern 550a (550b) are connected in parallel.

[0131] Although an example in which the liquid ejecting device is a printer has been described above, the liquid ejecting device may be a three-dimensional printer that forms a three-dimensional object by ejecting a liquid, a printer that dyes cloth by ejecting a liquid, or the like.

Reference Signs List

[0132] 1: printer (liquid ejecting device), 3: head unit, 50: driver IC, 54a, 54b, 56a, 56b: bump, 40: actuator substrate (structure), 442: cavity, 100: main board, 550: wiring pattern, Pzt: piezoelectric element, N: nozzle

plication of the drive signal to a third actuator, and a fourth ejection section that performs an ejection operation upon application of the drive signal to a fourth actuator,

the driver IC including:

a first electrode group that includes a plurality of electrodes including a first electrode that is electrically connected to one end of the first actuator and supplies the drive signal to the first actuator, and a second electrode that is electrically connected to one end of the second actuator and supplies the drive signal to the second actuator;

a second electrode group that includes a plurality of electrodes including a third electrode that is electrically connected to one end of the third actuator and supplies the drive signal to the third actuator, and a fourth electrode that is electrically connected to one end of the fourth actuator and supplies the drive signal to the fourth actuator;

a third electrode group that includes a plurality of electrodes that are electrically connected to the other end of the first actuator and the other end of the second actuator; and

a fourth electrode group that includes a plurality of electrodes that are electrically connected to the other end of the third actuator and the other end of the fourth actuator,

wherein, when the driver IC is viewed perpendicular to a mounting surface of the driver IC that is mounted on the structure,

the third electrode group is arranged along one side of the driver IC, the fourth electrode group is arranged along a side of the driver IC that differs from the one side, and

an area in which the first electrode group and the second electrode group are arranged is situated between an area in which the third electrode group is arranged and an area in which the fourth electrode group is arranged.

[Claim 8] The liquid ejecting device as defined in claim 7,

a plurality of the head units being arranged in parallel when viewed perpendicular to a liquid ejection plane.